

WISCONSIN FOREST MANAGEMENT GUIDELINES

PUB-FR-226 2003



Wisconsin Department of Natural Resources
Division of Forestry
PO Box 7921
Madison, Wisconsin 53707

For additional information, call **608-267-7494** or visit our web site at:
www.dnr.state.wi.us/org/land/forestry/

October, 2003

This document is intended solely as guidance, and does not include any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed.

This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any manner addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

The Wisconsin Department of Natural Resources provides equal opportunities in its employment, programs, services, and functions under an Affirmative Action Plan. If you have any questions, please write to

Equal Employment Opportunity Office, Department of Interior, Washington, D.C. 20240.

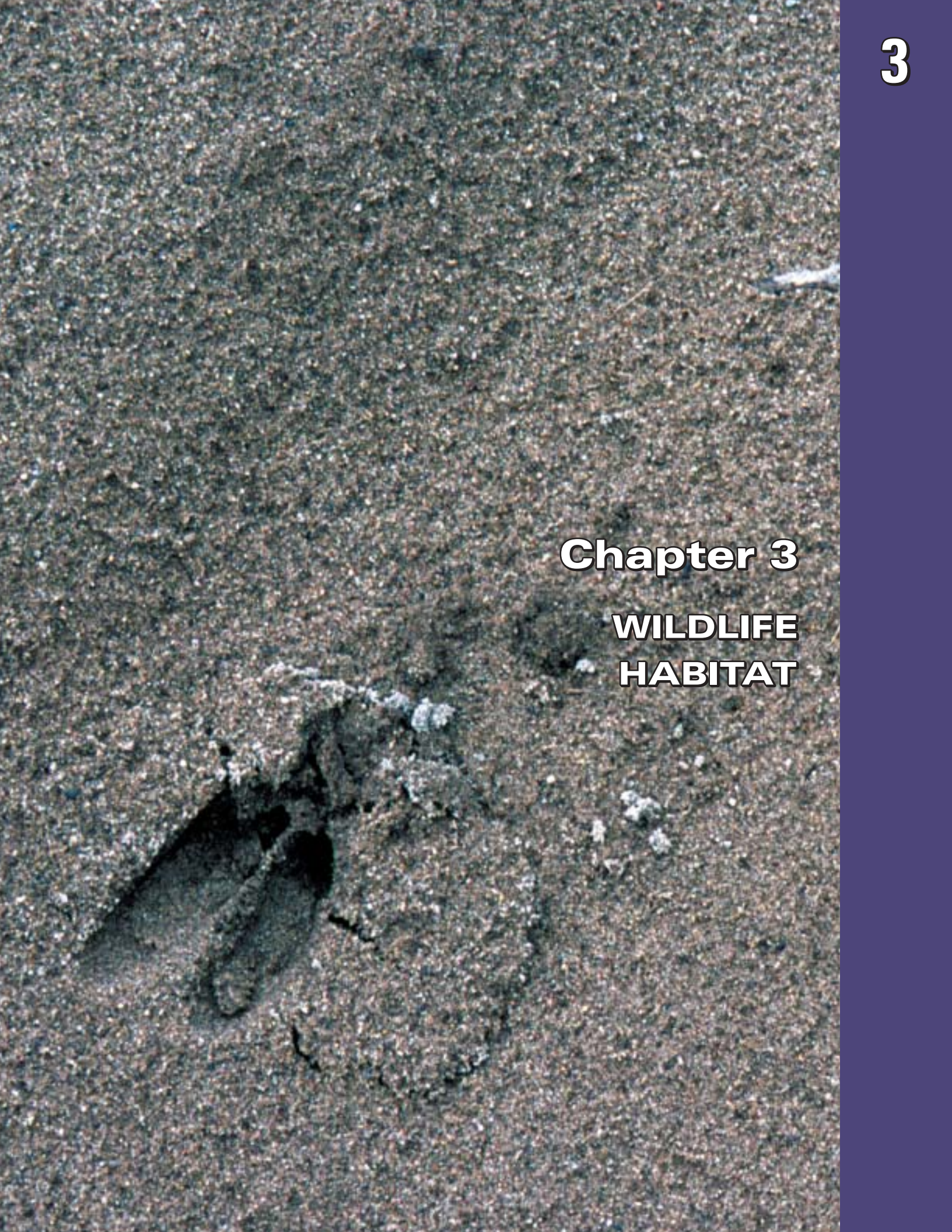
This publication is available in alternative format upon request.

Please call **608-267-7494** for more information.



Chapter 3

WILDLIFE HABITAT



CHAPTER 3 — WILDLIFE HABITAT

SPECIFIC WILDLIFE HABITAT GUIDELINES	49
Leave Trees and Snags	49
Coarse Woody Debris and Slash	51
Conifer Retention and Regeneration.....	52
Mast	55
Patterns of Cutting.....	56
Endangered, Threatened and Special Concern Species	58
State Natural Areas and Rare Natural Community Types.....	61
Affected Natural Communities	62
Field Survey Consultants and Other Resources.....	64
Wetland Inclusions and Seasonal Ponds.....	65
Riparian Wildlife Habitat	66
RESOURCES FOR ADDITIONAL INFORMATION.....	69



Wisconsin contains a diverse natural heritage with more than 2,652 plant species and 681 vertebrate species identified to date (Wisconsin Department of Natural Resources, 2003). In addition, thousands of fungi, invertebrates, and non-vascular plant species also contribute to healthy ecosystem functioning. Wisconsin is located at the junction of three of North America's six biotic provinces, thus generating a number of different habitats and niches for species to occupy. Wisconsin's forests lie within all three of these provinces and therefore are also quite diverse. The Society of American Foresters (SAF) lists 19 forest types that occur within the state. Each forest type occurs along a gradient of moisture, temperature, soil type, and climate, creating the different habitats and niches for species. All told a significant percentage of Wisconsin's native flora and fauna is associated with forested habitats.

Each species associated with a forested habitat or niche contributes to ecosystem functioning and, in turn, larger ecosystem processes. For example, studies have shown that insect-eating birds reduce overall levels of foliage loss from insect populations. As a result, bird populations can affect larger ecosystem processes such as carbon storage or primary productivity. Therefore, loss of organisms or groups of organisms from an ecosystem can have much larger consequences on forest health and larger ecological processes. The challenge is to conserve all the working parts within a particular ecosystem in order to maintain ecosystem resilience when disturbances occur. Simplified forest ecosystems suffer more damage from forest pests and are more likely to have problems regenerating effectively.

The primary focus of this chapter is on forest-dependent terrestrial and amphibious forms of wildlife. The intent is to provide practical, science-based guidelines to address a number of specific issues and projected impacts relating to forestry and wildlife. The resource directory contains DNR and non-DNR contacts that can provide additional information on management of all wildlife species.

Certainly, much more can be done to enhance wildlife habitat or individual species than the steps recommended in these guidelines. Furthermore, each management practice, including the option to do nothing, will favor some species and hinder other species. As a result, it is not practical to provide a comprehensive set of guidelines covering all possibilities for improving habitat in Wisconsin forests. Instead, these guidelines cover the essentials for addressing site-level issues related to forestry practices. Those interested in pursuing objectives that focus primarily on wildlife management are encouraged to consult a professional wildlife manager for more information.

It should be remembered that it is difficult to separate site-level and landscape-level issues. For wildlife, more than for other forest resources, what occurs on a site influences the surrounding landscape and vice versa. While the guidelines focus on the site level as much as possible, some of the more important "landscape implications" will also be discussed. Landscape-level wildlife needs can best be addressed through professional planning for individual properties and cooperation among landowners and agencies within a landscape.

Finally, many wildlife habitat guidelines can be applied simultaneously. For example, leave tree clumps in clearcuts might also serve as rare species buffers, provide mast production, and enhance vertical structure. These overlapping benefits may extend to other forest resources as well, such as for cultural resource protection and visual quality. In other cases, retention of various structural habitat components may create safety issues like the reduction of visual quality or increase the potential for pest damage. Other chapters of the guide will address some of the trade-offs that need to be considered relative to other resources.

SPECIFIC WILDLIFE HABITAT GUIDELINES

Leave Trees and Snags

PURPOSE

The purpose of this habitat aspect is to provide for wildlife requiring perches, tree cavities, and bark-foraging sites through retention of suitable leave trees and snags on a site during forest harvesting and timber stand improvement. This guideline will also contribute to the continued presence of coarse woody debris on a site.

RATIONALE, BACKGROUND AND BENEFITS

In Wisconsin, up to 30 breeding birds, nearly 30 mammals, and several reptiles and amphibians use snags as breeding sites. Different species have adapted to different ecological conditions. Saw-whet Owls utilize cavities in and around lowland conifer swamps, while Red-headed Woodpeckers nest in cavities in open or semi-forested conditions. The major issue for timber harvesting and cavity-dependent wildlife is whether suitable trees and nest cavities remain for these species following logging or timber stand improvement.

Retention of leave trees and snags during timber harvesting provides habitat for wildlife that require perches, tree cavities, or bark-foraging sites as the surrounding forest regenerates. Leave trees can be left scattered throughout a harvest area or in clumps as illustrated in Figure 3-9 (see page 63). The distribution and density of leave trees and snags will affect which wildlife species benefit from the practice. Leave trees can also impact regeneration after harvest. Snags and leave trees may also provide unique niches and microsites for a variety of plants, especially within retained clumps. Leave trees or snags that fall over and decay will also benefit soil conditions as well as wildlife that utilize coarse woody debris.

The fundamental idea is to retain some structure for snag- and cavity-dependent species on a site, or maintain the potential to produce such structure as a stand grows and develops (see Chapter 12: Timber Harvesting, for specific recommendations on leave tree and snag selection and distribution).

ECO-REGION APPLICABILITY

Cavity and snag trees are important statewide. Wildlife species that use cavities range in size from small mammals such as bats and mice, up to black bears. A range of tree sizes is necessary on a landscape scale to provide for the full use of this habitat feature.



Figure 3-1: Snags provide ideal conditions for wildlife requiring perches, tree cavities, and bark-foraging sites.

Openland or brushland management may require felling of all stems to reproduce open conditions needed in these habitats. Additionally, some forest types, such as aspen, require full sunlight for best regeneration and may require similar treatment. These forest types can function as openland during early stages of establishment. However, some openland wildlife species require cavities. For example, Eastern Bluebirds will nest in single, scattered snags in an open landscape. Generally, dead standing stems do not detract from the establishment or maintenance of openland/brushland habitat. However, they may provide structure for some undesirable wildlife species in some situations. European Starlings will nest in cavity trees in open or semi-forested landscapes if the site is adjacent or near an agricultural or urban/suburban setting. Starlings will out-compete other cavity nesting birds for this limited resource. In addition, if managing for openland species that are under severe predation pressure from raptors, consider removing all standing stems.



Figure 3-2: This strip of uncut pine provides a wildlife travel corridor through a clearcut area.

Cavity/snag trees are equally important in forested stands. There are a number of cavity-dependent species that require a larger forested acreage with sufficient canopy cover. Small mammals, bats and breeding birds that live in heavily forested areas also nest in cavities and use snags for foraging sites. Black-capped Chickadees and Tufted Titmice are only two of a number of charismatic forest bird species that nest in cavities. When conducting a single-tree selection harvest consider leaving snag and cavity trees of varying diameters. Barred Owls and Pileated Woodpeckers utilize large cavities and snag trees, while Downy Woodpeckers and Chickadees utilize smaller trees. In addition, these trees will also eventually topple and contribute to coarse woody debris on the forest floor.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for snags and leave trees, the contribution of an individual site should be considered in the context of the surrounding landscape. Many of the cavity-dependent species being addressed have home

ranges larger than the typical harvest unit, so planning for their needs requires a broader look, both spatially and temporally, at the larger forest community. Many other species have smaller home ranges than the typical harvest unit.

If suitable habitat exists surrounding a given harvest site, then leave trees may not be as critical on that site. However, if harvests are likely in the adjacent habitats, then the trees left on the initially harvested sites become more important as the surrounding forest regenerates. Consideration must be given to the time it takes for a regenerating stand to produce trees of adequate size and degree of decay to provide suitable structure.

Coordination among neighboring landowners may result in varying numbers of leave trees on a site if adjacent lands exceed or fall short of the recommendations. Managers of larger land-holdings may be able to plan for sufficient cavity-dependent wildlife habitat on portions of their property (such as riparian reserves) and reduce leave tree/snag requirements on other portions.

Coarse Woody Debris and Slash

PURPOSE

The purpose of coarse woody debris and slash is to provide cover, food or growing sites for a diverse group of organisms through the retention or creation of coarse woody debris and slash during forest management.

RATIONALE, BACKGROUND AND BENEFITS

A wide variety of organisms benefit directly or indirectly from presence of coarse woody debris and slash. Small mammals dependent on slash and coarse woody debris in turn provide food for mammalian carnivores and forest raptors (such as the pine marten and the Broad-winged Hawk). Amphibians such as Wood Frogs, Four-toed Salamanders, and Red-backed Salamanders utilize the cool, moist microsites created by coarse woody debris as resting/feeding areas.

Woody detritus reduces erosion and affects soil development, stores nutrients and water, is a major source of energy and nutrients, serves as a seedbed for plants, and is a major habitat for microbes, invertebrates and vertebrates. For example, yellow birch, white cedar and eastern hemlock regeneration is enhanced by coarse woody debris. These tree species are important components of a diverse northern forest, and provide habitat for an untold number of vertebrate and invertebrate species. Bird researchers in northern Wisconsin found that hemlock dominated natural areas contained higher species diversity and richness than the even-aged managed hardwood sites that dominate this landscape.

The fundamental idea is to retain or enhance the amount of coarse woody debris in a stand in order to benefit the organisms associated with coarse woody debris, and to support nutrient cycles that benefit healthy forests (see Chapter 12: Timber Harvesting, for specific recommendations on coarse woody debris).



Figure 3-3: Coarse woody debris provides cover, food, habitat structure, and growing sites for many different animals and plants.

ECO-REGION APPLICABILITY

Coarse woody debris is important to forests and forest organisms statewide. Each eco-region has a number of species that utilize slash and coarse woody debris. In the north, birds such as Winter Wrens and Ruffed Grouse utilize downed logs for nesting/feeding sites and for territorial displays. Blue-spotted or Northern Red-backed Salamanders enjoy the moist, cool microsites provided by rotting logs on the forest floor. In the south, birds such as Hooded Warblers or Kentucky Warblers may be taking advantage of the arthropods that live in and around coarse woody debris. Regardless of the location, coarse woody debris and slash is an important component of the forest ecosystem.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for snags and leave trees, the contribution of an individual site should be considered in the context of the surrounding landscape. Coarse woody debris left on a specific site may be benefiting reptiles and amphibians living there but breeding elsewhere. Thus, coarse woody debris placement might be influenced by off-site factors. For example, when managing a pine plantation, coarse woody debris may be important as a salamander migratory corridor between an adjacent hardwood forest and a wetland breeding site. However, if the pine plantation is bordered by other dry or arid cover types, and lacks wetlands of any type, coarse woody debris may not be important to salamanders at this site.

The size and position of intensive timber management may also determine the importance of coarse woody debris to associated organisms. For example, if a clearcut takes place surrounding a temporary wetland, coarse woody debris left in the clearcut and in the wetland would be essential habitat for breeding salamanders. Increased sunlight in the pond and harvested stand makes desiccation a problem for salamanders. More downed logs would provide cool, moist microsites in order to avoid direct sunlight during the heat of the day. In addition, leaving downed logs would also provide drumming sites for Ruffed Grouse. If however, the clearcut was smaller and the wetland was bordered by older forest, coarse woody debris left in the clearcut would not be as important for salamanders. However, it still may perform other ecological functions important to the forested stand.

Conifer Retention and Regeneration

PURPOSE

The purpose of this aspect of habitat is to ensure diversity of wildlife habitat through the retention and regeneration of conifers for food, nesting and cover in mixed deciduous/coniferous stands. Conifers should continue to be a significant structural component in appropriate habitats and landscapes.

RATIONALE, BACKGROUND AND BENEFITS

Many wildlife species benefit from a mixture of conifer and deciduous trees and shrubs. Retaining young conifers, including isolated trees and scattered clumps, can provide habitat and food needed for many wildlife species, and can increase the probability that conifers will later regenerate on harvested areas.

Various animal species, including the Great Gray Owl, Bald Eagle, Pine Warbler, white-tailed deer, elk, pine marten, lynx, snowshoe hare, and red-backed vole, depend on coniferous stands for structural attributes. Others – including Spruce Grouse, Red-breasted Nuthatch, red squirrel, porcupine, and elk – depend on food that coniferous stands provide. Deer and elk will often winter in conifer forests due to the reduced snow depths and thermal cover that these stands provide. Many species associated with the boreal forests of Canada reach the southern limits of their range in the coniferous and mixed coniferous forests of northern Wisconsin. Examples of these include pine marten, fisher, gray wolf, Cape May Warbler, Boreal Chickadee, Great Gray Owl, Gray Jay and Palm Warbler.

Historically, conifers often existed as scattered trees or clumps within hardwood stands. Many of these conifers have been lost due to poor regeneration following early logging. A number of species are adapted to these scattered overstory conifers or patches of conifer within a hardwood stand. Pine Warblers are often heard singing from scattered overstory white pines that have persisted or regenerated within an oak or maple forest. Bald Eagles or Osprey often use these scattered superstory trees as nesting or roosting sites. Often aspen/birch stands in northern Wisconsin contain patches of regenerating or mature white spruce or balsam fir. Birds such as Cape May Warbler, Magnolia Warbler and Canada Warbler will locate territories in and around these coniferous patches. These dense areas of conifer also provide thermal cover for grouse, deer and other northern species during cold winters and warm summers.

When retaining conifers, clumps are preferable to scattered trees. Clumped conifers are more windfirm, are better potential seed sources because of improved pollination, can withstand snow and ice loads more successfully, and can provide better cover (see Table 3-1, page 54).



Figure 3-4: A deer trail meanders through a frost-covered opening. The retention of openings, created as log landings during harvesting, or as the result of other forest operations, can help provide a mix of habitat conditions for many wildlife species.

ECO-REGION APPLICABILITY

These guidelines are most applicable to the northern part of the state. Certain areas in west-central and central Wisconsin that do contain areas dominated or co-dominated by white and jack pine may also benefit from these recommendations.

It is important to match existing site conditions and silvicultural objectives to plans for conifer retention and regeneration. Consult the silvicultural handbook or DNR staff for distributions of different conifer species within different ecological landscapes. Conifer regeneration and retention will work best if done in appropriate conditions and site locations. For example, retention and regeneration of fir and spruce in aspen/birch stands would be most appropriate on the Superior Coastal Plain and other areas of northern Wisconsin that historically supported a mixed aspen/spruce forest type. Retention and regeneration of white or red pines might be most effective in the Northern Highland landscape, where white and red pines once dominated forest canopies.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for conifer retention and regeneration, the contribution of an individual site should be considered in the context of the surrounding landscape. When discussing conifer retention and its importance to wildlife, landscape scale management can be very important. Many species that utilize coniferous or mixed/coniferous woods have much larger home ranges than the particular stand being considered for management, therefore, it is important to take into account neighboring properties. In other situations, scattered leave trees or clumps of conifer regeneration will provide wildlife benefits, even when isolated from similar conditions.

If the stand being considered for management is bordered by coniferous forest, or if the region contains a large percentage of coniferous/mixed coniferous forest, then conifer retention or regeneration will have a greater likelihood of benefiting those species with larger home range needs or area requirements. Species such as Blackburnian Warblers, Connecticut Warblers or Cape May Warblers will use conifer retained in managed areas if these landscape conditions are met. Often, small songbirds such as these will nest in loose colonies where extra-pair matings are an important part of the breeding strategy. Larger patches of habitat will increase the chances that this mating system will work.

If the stand being considered for management is isolated from appropriate coniferous or mixed coniferous habitat, it will be of lesser value to those species needing large areas of this habitat. However, other species may utilize smaller patches of coniferous regeneration. For example, small patches of thick fir or spruce may harbor wintering Ruffed Grouse or Saw-whet Owls. Scattered white pine canopy trees can be important nesting areas for Pine Warblers or Bald Eagles.

CONIFER SPECIES	EXAMPLES OF USES BY WILDLIFE
Red Pine	Mature trees may be used by raptors for perches or nest trees. Seeds are important mast for winter songbirds and red squirrels. Larger stands of mature trees provide breeding habitat for Red Crossbills, Pine Warblers, Blackburnian Warblers, and Pine Siskins. Mature stands with dense deciduous or coniferous understories can contain diverse breeding bird assemblages, including some rare species.
White Pine	When young, provides good escape and severe winter cover for many species. High calorie, large seeds eaten by many small mammals and winter songbirds. Mature trees are important for cavity-dependent wildlife, preferred Bald Eagle nest trees, and escape trees for bears. Roosting trees for Wild Turkeys where present in central and southern Wisconsin.
Jack Pine	Very good cover for a number of species when trees are young and stands are well-stocked. Used as browse, most notably by Spruce Grouse. Seeds eaten by red squirrels and Red Crossbills. Persistent cones provide a year-round food source. Mature stands in north-western Wisconsin home to rare Connecticut Warbler.
Balsam Fir	Important winter and summer cover for deer, elk and many species of birds. Birds eat seeds and use trees for nesting. When allowed to persist in hardwood understory, is important nesting cover for Black-throated Blue Warblers and other bird species. Thermal cover for grouse and owls.
Black Spruce	Important escape and severe winter cover. Birds such as White-winged Crossbills eat seeds and use trees for nesting. Buds and needles are important Spruce Grouse food. Often have diverse and abundant small mammal populations, which are important food sources for owls and other forest raptors. Black spruce wetlands contain many vertebrates and invertebrate species not commonly found in Wisconsin. Dead or dying trees often provide insects and snags for Black-backed Woodpeckers.
Tamarack	Mature stands provide excellent habitat for owls and other birds. Snags are used as hunting/singing perches. Seeds are eaten by small mammals, Pine Siskins and Crossbills.
White Cedar	Mast is important food source for winter songbirds. Very important winter cover for deer. Important for browse during severe winters. Provides cover and cooling effect near water.
White Spruce	Important seed source for winter finches. Summer nest cover for rare songbirds such as Cape May Warbler and Evening Grosbeaks. Thermal cover for owls and grouse.
Eastern Red Cedar	Important winter cover in southern Wisconsin. Fleshy berry-like cones used by birds for food.
Hemlock	Hemlock-dominated forests or mixed stands contain distinct breeding bird assemblages not found in hardwood forests. Mature trees provide important owl roosting sites. Mast important to red squirrels and winter finches.

Table 3-1: Conifer Species and Examples of Use by Wildlife

Mast

PURPOSE

The purpose of this habitat aspect is to provide for wildlife that utilize mast production from trees and shrubs.

RATIONALE, BACKGROUND AND BENEFITS

Many species of trees and shrubs have developed a seed dispersal system that benefits many species of wildlife. Producing mast in the form of nuts or berries encourages mammals such as squirrels or birds to eat or transport the seeds to other areas. Oaks may produce thousands of acorns in the hope that a Blue Jay or Turkey will accidentally scratch one into the forest soil. Dogwoods and juneberries will produce fruit attractive to migrating birds, which will pass the seeds to neighboring areas during migration. This complex reproductive strategy is essential to the inner workings of many ecological systems in Wisconsin.

High levels of fat, protein and carbohydrates in mast contribute to energy stores critical for migration or hibernation, and for survival of newly-independent young. Many birds that eat insects on breeding grounds will consume berries during fall migration. Yearly variations in mast production may impact subsequent reproductive success of many species. Often, plentiful mast production will lead to abundant small mammal populations, which in turn benefits forest carnivores that prey on small mammals. During winter, some sources of mast remain available to forest wildlife on trees and shrubs, under snow or stored in caches (see Table 3-2, page 56).

Mast production is generally favored by increased crown exposure to light, crown size, maturity of trees or shrubs, increased soil nutrients, tempered microclimates (especially during flowering), and adequate soil moisture. Production on a site tends to vary considerably from year to year.

Other considerations with respect to mast include:

- Mast-producing species often depend on animals for their dispersal and reproduction.
- Riparian edges often contain a higher concentration and richness of mast-producing species.
- Most shrub species will regenerate well and produce mast after cutting, burning or soil disturbance.

Although concerns for oak and other dominant tree species are particularly important, especially in relation to game species (such as deer or gray squirrels), other mast species also provide important benefits.

ECO-REGION APPLICABILITY

Retention of mast and other key food-producing tree types should be prioritized in accordance with the local abundance of each tree species. In areas of least abundance, greatest attention should be applied to retention. Planning silvicultural treatments to increase mast-producing trees should be performed in accordance with silvicultural guidelines laid out in the DNR silvicultural handbook.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for mast production, the contribution of an individual site should be considered in the context of the surrounding landscape. Land managers in regions with low mast availability have opportunities to enhance wildlife habitat characteristics by careful management of mast species on their land. Some wildlife species may travel significant distances to obtain mast. The black bear, for example, may travel 10 miles to obtain mast. Breeding birds will often relocate family groups to wetland edges, or areas with increased levels of berries during late summer before migration. In areas with sufficient mast production, mast production may not be as important.

MAST SPECIES	EXAMPLES OF USES BY WILDLIFE
Oaks (acorns), beech and hazel nuts	Deer, bear, Wild Turkey, Woodpeckers, Blue Jay, Wood Duck, squirrels
Maple and ash seeds	Small mammals, Evening and Pine Grosbeaks
Aspen, birch and hazel buds	Ruffed Grouse
Yellow and white birch seeds	Common Redpoll, Pine Siskin, American Goldfinch
Conifer cones and seeds (such as white cedar, balsam fir, black spruce, white pine, common juniper, red cedar, Canada yew)	Red squirrels, White-winged and Red Crossbills, Pine Siskins, Red-breasted Nuthatch, Pine Grosbeak
Late summer soft mast (such as juneberries, blueberries, cherries, dogwoods, and elderberries)	Important to a number of birds and mammals as they prepare for migration and winter
Soft mast retained in fall and through winter (such as mountain ash, cranberry and nannyberry, winterberry)	Waxwings, Pine Grosbeaks and other bird and mammal species
Vines (such as wild grape)	Numerous bird and mammal species

Table 3-2: Examples of Mast-producing Plants that Will Benefit Wildlife in Wisconsin

Patterns of Cutting

PURPOSE

The purpose of this habitat aspect is to provide site- and landscape-level wildlife habitat requirements by using a variety of sizes and shapes of harvest areas. Understanding the impact from site-level management on the larger forested area will help land managers make better wildlife decisions.

RATIONALE, BACKGROUND AND BENEFITS

This management objective will involve making silvicultural decisions on a landscape basis. Ideally, the management regime should range from the very fine-scale management represented by selection cutting to the coarse-scale management affected by sizable clearcuts. The size of clearcuts and other treatments should be determined by considering issues such as size of the management unit, the home range requirements of large animals, aesthetics, and natural disturbance regimes.

Although ownership considerations may preclude this, size and shape of both cut and uncut areas should mimic natural disturbance regimes that historically impacted the forest type to be managed. This will then benefit the native species of plants and animals adapted to this forest type and disturbance regime. Larger patch sizes historically occurred under natural disturbance regimes on even-aged, fire-dependent types, such as jack pine. Large clearcuts in such types can function for a short time as habitat for some area sensitive openland species such as Sharp-tailed Grouse and Upland Sandpipers.

These managed areas will be of even greater benefit to openland species if they are placed adjacent to more permanent open barrens. Colonization of new openland habitat created by forest management is much more likely to occur if it is adjacent to existing populations of openland species. As the managed area ages, it will become less attractive to openland species, but other early successional species such as Eastern Towhees and Brown Thrashers will colonize the site.

Smaller patches are appropriate in more heterogeneous forest types, such as deciduous forests on moraines. For example, northern mesic forests dominated by sugar maple, hemlock or beech were much more likely to undergo disturbance from wind than from large fires. Most wind events created smaller patchy canopy gaps within a larger forested matrix. Species like Black-throated Blue Warblers nest within the thick regeneration generated by these disturbance events, and thus could benefit from a silvicultural treatment that mimics this process.

The shape and size of the cutting area determines the total amount of edge habitat created through management. An **edge** is defined as the transition area between two different forest types or successional stages. This transition zone can be “hard” (between a forested habitat and a field) or “soft” (between two age classes of forest habitat). “Hard” edges tend to be permanent, and may have more impact on wildlife than “soft” edges. “Soft” edges can also form as forest expands into open habitats. These “soft” edges differ from the regeneration found in canopy gaps by virtue of the amount and distribution of the regenerating age class. The amount and type of edge in a landscape will create conditions favorable for some species and detrimental to others. Many game species such as white-tailed deer and Ruffed Grouse, along with Indigo Buntings and Chesnut-sided Warblers, prefer the wide variety of cover and food resources found along forest edges, and tend to be very good competitors for those resources. Landscapes with high amounts of natural or man-made edges tend to favor these edge species. However, many species of birds, some mammals and herps prefer the interior of larger (greater than 100 acres) blocks of forest. Cerulean Warblers, Acadian Flycatchers, Hooded Warblers, Black-throated Blue Warblers, and many other interior species are listed as endangered, threatened or species of special concern by the Bureau of Endangered Resources due to loss of appropriate habitat. A large increase in the amount of edge, through forest management activities or a natural disturbance in large blocks of forest, will increase edge species which will replace many interior species.



Figure 3-5: Two age classes of aspen, managed for grouse by clearcutting, illustrate the “edge” where two stands meet.

ECO-REGION APPLICABILITY

The soils, climate and geology of different eco-regions across the state favor different types of forests. Each forest type and its associated wildlife are adapted to a particular disturbance regime. Ideally, forest management activities should take these disturbance regimes into account.

In general, more diverse and larger patch sizes are possible in northern Wisconsin than in the forest fragments of southernmost Wisconsin. Since many of our southern forests have been converted to other uses, special consideration should be given to conserving large patch sizes of existing forests.

LANDSCAPE IMPLICATIONS

When employing large clearcuts, consider harvesting in segments over several years. This will provide both early successional diversity and, over the long-term, a large mature forest stand. Coordinate with adjacent landowners when natural stand boundaries cross property lines.

Endangered, Threatened and Special Concern Species

PURPOSE

The purpose of this section is to increase awareness of endangered, threatened and special concern species

(ETS species), and the need to maintain or enhance populations of these species. In addition, this section will help to increase awareness of statewide forest policies to consider endangered and threatened species in the forest management decision-making process.

Frequently Asked Questions

WHAT DOES IT MEAN WHEN RARE SPECIES ARE FOUND ON MY LAND?

It means you have land that is quite different than most properties in the state. Native species that have been eliminated elsewhere still find a home on your land. This may have some legal obligations, but it may also yield some benefits.

WHAT IS THE DIFFERENCE BETWEEN ENDANGERED AND THREATENED SPECIES?

Endangered means the species is in danger of becoming extinct. Threatened means the species is less vulnerable, but a chance exists that they will soon be endangered.

WHAT IF THE SPECIES ARE PLANTS?

The plants that are found on private property belong to the landowner. What becomes of them is the decision of the landowner. Of course, the Department of Natural Resources wants to encourage and help the landowner protect and manage these valuable plants.

WHAT IF THE RARE SPECIES TURN OUT TO BE BIRDS OR OTHER ANIMALS?

Because animals usually travel freely from one property to another, they belong to everyone. Laws determine what anyone can do with these species. For example, it is illegal to shoot a timber wolf in Wisconsin, although it is not illegal to shoot a white-tailed deer in season. Laws also protect nesting birds or turtles from being disturbed during the nesting season. For example, it is illegal to disturb an active Bald Eagle nest. Sometimes habitats are protected. Many of our State Natural Areas protect large pieces of rare habitats such as beach dunes, sedge meadows, or old growth forest. These rare habitats often host a number of rare plants and animals. Chiwaukee Prairie State Natural Area in Kenosha County hosts 40 rare plants, birds, butterflies, insects, turtles, and natural communities.

IF AN ENDANGERED SPECIES IS FOUND, WHO WILL GET THIS INFORMATION?

The information is shared with the landowner or land manager, of course. Otherwise, it is confidential. It is not dispensed to the media, and is exempt from the open records law.

HOW DOES A LANDOWNER BENEFIT FROM THE KNOWLEDGE THAT AN ETS SPECIES OCCURS ON THEIR PROPERTY?

You learn from biologists what makes your property special. You may get help with managing the natural resources on your land. Several programs are in place that can provide tax advantages or cost-sharing for management. Knowledge of the occurrence of rare plants and animals is increasing every year. The best information on occurrences of rare species is the Endangered Resources Program's Natural Heritage Inventory. Information on publicly-owned land is relatively good, however, private land is inventoried only with permission of the landowner, and coverage is very patchy.

RATIONALE, BACKGROUND AND BENEFITS

By definition, ETS species are rare. Wisconsin is home to more than 12,700 fungi, 2,652 plant species, 37,000 invertebrate species, and 681 vertebrate species. The Wisconsin Department of Natural Resources lists 859 of these plants and animals as endangered, threatened or special concern, with more than 28 percent – 245 species – further identified as species that may be affected by forest management activities. Five of these are also listed as federally endangered or threatened.

All species found in a natural forest ecosystem contribute to its healthy functioning. Humans tend to place values on the species found in these ecosystems, however, for the plants and animals living in the forest, no value judgment is given. They are there because that's where they live. Only we can make decisions affecting their habitats. Management decisions should occur with the best information available. Reasons for considering all species in the decision include the following:

- Conservation of species because of their innate values.
- Conservation of rare species that play a critical role in ecosystem function.
- Conservation of nutrient recycling and soil enhancing animals and fungi.
- Conservation of natural disturbance regimes.
- Deter invasion by aggressive, non-native invasive species.
- Conservation of genetic strains that are adapted to local climate and site conditions.
- Conservation of aesthetic and recreational values.
- Conservation of species that may produce economically-valuable products or provide eco-tourism benefits.
- Scientific and educational benefits.

PROTECTION AND MANAGEMENT

Most forest management activities will not involve ETS species. Even when they are found, the laws seldom totally prohibit activities. The landowner owns the plants found on the property. On public land, endangered and threatened plant species are considered when developing a management plan or conducting a timber sale. Endangered and threatened animal species are protected by law, but many can be incidentally taken, if certain restrictions are followed. Special concern species have no legal protection, but that does not abdicate the responsibility to consider them in planning actions.

When found, most ETS species tend to be found in specialized habitats. Seeps, ephemeral ponds, cliffs, extensive bog areas, old-growth forest, and large blocks of southern Wisconsin forest harbor a vast majority of the 245 forested ETS species. Many species are also localized in their distribution. Several species are found in only a few locations in the state with the rarest species almost exclusively found on publicly-protected land.

Many studies on the relationship between timber harvest and vertebrates provide a basis for making decisions regarding those rare species. Relatively little is known about the impacts of timber harvest on rare plants and especially invertebrates. Long-lived and slow-dispersing understory plants and invertebrates, especially those that have their optimum habitat in late-successional or old-growth forest, may be particularly affected by timber harvest.

The Managed Forest Law (MFL) applies sound forest practices of timber cutting for effective propagation, or improvement of various timber types. Sound forest practices also include, where consistent with landowner objectives, management of forest resources for endangered and threatened plants and animals. MFL applications are screened for occurrences of endangered and threatened species through the Natural Heritage Inventory (NHI) On-line Database maintained by the Bureau of Endangered Resources (BER).



Figure 3-6: Cavity trees enhance the quality of wildlife habitat.

LEGAL PROTECTION

Endangered and threatened species are protected in Wisconsin by one or more of the following laws: the Federal Endangered Species Act of 1973 (Public Law 100-478), Lacey Act, Migratory Bird Treaty Act, Bald Eagle Protection Act, Wisconsin Endangered and Threatened Species Law (State Statute 29.604 and Administrative Rule NR27), and the Wisconsin Non-game Species regulations (State Statute 29.039).

Other laws, both state and federal, may apply to the protection of plants and animals in the state. Specific information may be obtained from your local DNR office, or the BER Endangered Resources Program (see the Resource Directory).



Figure 3-7: Eagle nest in the top of a white pine tree. Leaving trees like this provide ideal sites for nesting.

Other sources of information include:

- Local DNR biologists, conservation wardens, foresters, park managers, or naturalists.
- Nature centers, colleges and universities, and University of Wisconsin-Extension offices.
- NHI On-line Database, www.dnr.state.wi.us/org/land/er/nhi/NHI_ims/onlinedb.htm
- NatureServe Web Site, www.abi.org
- Wisconsin Vascular Plant Web Page, University of Wisconsin Herbarium, wiscinfo.doit.wisc.edu/herbarium/
- Breeding Bird Atlas Maps for Listed Species, www.uwgb.edu/birds/wbba/
- Wisconsin Herpetological Atlas Web Site, www.mpm.edu/collect/vertzo/herp/atlas/atlas.html

State Natural Areas and Rare Natural Community Types

PURPOSE

The purpose of this habitat aspect is to increase awareness of protected state natural areas and rare (including geographically restricted) natural community types. Generally, natural areas are tracts of land or water-harboring natural features, which have experienced the least intrusive degrees of human disturbance, and which represent the diversity of Wisconsin's native landscape. They contain outstanding examples of native biotic communities, and are often the last refuges in the state for ETS species. Natural areas may also include exceptional geological features. State Natural Areas are officially recognized parcels that can be visited to better understand the ecology of forests with little past disturbance. Rare natural community types are either scarcely found on the landscape or harbor a seral stage that is rarely found in today's forested ecosystem (see pages 62-64 for descriptions).

RATIONALE, BACKGROUND AND BENEFITS

Natural areas and rare natural community types represent only a small portion of the total forested area of the state. A statewide, county by county, inventory for the presence of natural areas was completed by the State Natural Areas Program in the period of 1969 through 1983. Each site was evaluated for landscape characteristics, natural community site values and species viability.

Since 1985, this data and subsequent natural areas data is housed in the Natural Heritage Inventory (NHI) database. This program tracks rare natural communities plus many others that are geographically restricted, contain older seral stages, or harbor diverse concentrations of species. Among the rare natural communities such as oak openings, mesic prairies and algific talus slopes nearly all occurrences are tracked. For relatively common natural communities, such as northern mesic forests, the tracked occurrences represent those examples least disturbed by human activities (e.g., older successional stages) as well as areas that support exceptional biotic diversity. The significance of a given natural community occurrence is therefore related to not only its quality and condition, but also its size, context, and relative condition to more degraded examples.

The presence of natural areas or sensitive natural communities can provide many benefits for the landowner and citizens of the state:

- Protect habitat for ETS species.
- Provide reference areas to compare the effects of more intensively managed areas. Best used in an adaptive management situation and often times can accommodate some active management.
- Provide opportunities for scientific research where natural processes are allowed to proceed essentially unimpeded.
- Provide opportunities for formal and informal education to gain an appreciation and understanding of biotic communities and their component species.
- Apply the principles of ecosystem management to the forest.
- Provide areas which are managed more intensively (barrens and savanna) or less intensively (late succession to old-growth forest) than normal sustainable forest practices.
- Protect significant geological features.
- Provide a reservoir of genetic and biological diversity.

Natural areas and rare natural community types are often managed by avoidance, while other sites can be maintained by fire, or appropriate silvicultural techniques.

The best information on natural areas and sensitive natural communities is provided by the DNR State Natural Areas Program in the Bureau of Endangered Resources (BER). A compilation of known occurrences of sensitive natural communities can be found at the BER web site listed under information sources. The extensive statewide inventory covered only a fraction of the forested land in the state. Many sites remain unknown. Identifying natural areas and sensitive natural communities can be challenging, and may require expert evaluation.

Affected Natural Communities

The following natural communities may possibly be affected by activities. The database of communities is based on State Statute 23.27 to identify natural areas meeting a critical level of importance in the state. The Endangered Resources Program manages the list of these forest communities:

- **Black Spruce Swamp:** Characterized as a conifer swamp with high canopy closure dominated by closed canopy black spruce. Significant examples have old trees greater than 100 years and large size greater than 40 acres, or are found with a diverse array of other forested wetland types.
- **Bog Relict:** This geographically limited community is found in south of the tension zone in Wisconsin, and contains many of the more widespread bog species from the north. These relicts are often isolated from similar northern communities and many times contain rare species.
- **Boreal Forest:** A forest community dominated by white spruce, white cedar, white pine, balsam fir, and paper birch is limited to areas near the Great Lakes. Mature forests are rare in Wisconsin, and old-growth examples are virtually non-existent.
- **Central Sands Pine-oak Forest:** This recently described and geographically limited natural community is found in Central Sands eco-region, and characterized by a diverse canopy of red pine, white pine, several oak species, and red maple. The ground layer is sparse, mostly penn sedge and blueberries. Virtually no sites have been identified for ecological study.
- **Floodplain Forest:** Also known as bottomland hardwoods is found along most of our large rivers. Characteristic trees include silver maple, river birch, green ash, hackberry, cottonwood, swamp white oak, and formerly elms. These forests are very diverse and larger patches can provide habitat for several rare species. Ecologically important sites contain trees greater than 100 years, and have unrestricted flood pulse events.
- **Forested Ridge and Swale:** This rare forested community complex is limited to a narrow fringe along the Great Lakes, and formed on old dunes and beach ridges created during past high water events.
- **Hemlock Relict:** These are isolated hemlock stands occurring in deep moist ravines or on cool, north and east-facing slopes in southwestern Wisconsin. These relicts are very rare with extremely small opportunities for enhancement or expansion. They should be treated with a very, light hand, if at all.
- **Mesic Cedar Forest:** This is a rare upland forest community of mesic sites in northern Wisconsin, characterized by white cedar as a co-dominant tree. Associates include hemlock, white spruce, yellow birch, and white pine. All stands of this type are rare and should be considered for alternative management.
- **Mesic Floodplain Forest:** A very rare natural forest community found on alluvial terraces of streams flowing into Lake Superior. This forest is characterized by typical northern hardwood in the canopy, but the ground layer has an exceptionally diverse spring ephemeral flora with many southern species reaching their range limit. These rare isolated terraces should be managed with a very, light hand, if at all.



Figure 3-8: A bald eagle resting on a white pine branch in northern Wisconsin.

- **Northern Dry Forest:** This relatively common forest community is characterized by the presence of jack pine, Hill's oak and occasional red pine. Stands of special ecological interest were generated after a catastrophic fire, have older age classes with many openings, and are planned for regeneration using prescribed fire.
- **Northern Dry-mesic Forest:** A forest community dominated by various combinations of white pine, red pine, red oak, and red maple, this type is very common in the state. Stands of special ecological interest are greater than 100 years of natural origin with a special emphasis on those stands with continued fire management.
- **Northern Hardwood Swamp:** This natural forest community is found along lakes, rivers and isolated basins with the predominant species being black ash. Sites of special ecological interest are those greater than 100 years found along rivers or lakes having intact hydrology with little chances of being killed by beaver activity, and those found in extensive tracts or large basins.
- **Northern Mesic Forest:** A combination of forester's northern hardwood and hemlock/hardwood cover types, this natural forest community is our most common. Stands of special ecological significance are those containing trees greater than 100 years old, numerous tip-up mounds, abundant coarse woody debris, embedded vernal pools, and extensive tracts covering numerous landforms.
- **Northern Wet Forest:** Roughly equivalent to the swamp conifer cover type, this forest is dominated by black spruce, tamarack and occasionally jack pine. Stands of special ecological significance are greater than 120 years old, have nearly continuous canopy, and are relatively free of dramatic water level fluctuations.
- **Northern Wet-mesic Forest:** Roughly equivalent to the white cedar cover type, this natural forest community is dominated by white cedar, but also has significant balsam fir, black ash and spruces in the canopy. Most stands have a special ecological significance due to the confounding effect of deer on cedar regeneration. Until effective cedar replacement can be assured, most stands should be considered for alternative management.
- **Oak Woodland:** Once relatively common on Wisconsin's landscape, this natural forest community roughly intermediate in structure between oak opening and southern dry forest, is now virtually non-existent. Ecologically significant sites lie entirely in the realm of restoration. Sites should be evaluated for canopy structure, remnant oak woodland ground layer species, and availability for long-term fire management. Assistance for evaluations may be provided by BER.
- **Pine Relict:** Similar to hemlock relict, these conifer dominated communities are found in isolated locations in the driftless area of southwestern Wisconsin. This natural community has red pine, white pine and occasionally jack pine as the dominants, and is found on sandstone outcrops. Regeneration is often problematic and should be attempted only with great care.



Figure 3-9: Numerous "islands" of uncut trees in this clearcut stand, along with scalloped edges, provide good wildlife habitat and improved visual impact after timber harvesting.



Figure 3-10: Course woody debris in riparian and upland forests provide great habitat for nesting and foraging salamanders, small mammals, and birds such as this Cape May Warbler.

- **Southern Dry Forest:** This natural forest community represents the oak cover type found on dry, especially sandy, sites. White oak and black oak are the dominants, and often red oak and black cherry are associates. Shrubs are well-developed and diverse. Sites with special ecological significance are those greater than 100 years old with numerous standing and fallen dead trees.
- **Southern Dry-mesic Forest:** Most closely associated with the red oak or central hardwoods cover types, this natural community is dominated by red oak with significant inclusions of white oak, basswood, sugar maple, red maple, and white ash. Sites with special ecological significance are those greater than 100 years containing numerous tip-up mounds, coarse woody debris, vernal pools, seeps, and crossing different landforms.
- **Southern Hardwood Swamp:** This natural community is associated with isolated basins in glaciated southeastern Wisconsin. Common dominants are red maple, green ash, and formerly American elm. This natural community is rarely found in an unmanipulated condition. Sites with special ecological significance are any without or very few invasive exotics, such as buckthorns, honeysuckle and reed canary grass.
- **Southern Mesic Forest:** This natural forest community can be confusing, because it is analogous to the northern hardwood cover types. However, it's found primarily south of the tension zone and usually has much different ground layer species than northern hardwoods north of the tension zone. Stands of special ecological significance are those greater than 100 years, larger than 120 acres, abundant coarse woody debris, embedded vernal pools, and seeps.
- **Tamarack (Poor) Swamp:** This natural community is a broken or closed canopy tamarack swamp growing under limited influence of mineral enriched water. A common associate is alder in the shrub layer. This community has only recently been described, and stands for ecological study have not been established.
- **Tamarack (Rich) Swamp:** This geographically limited forested wetland community is found south of the tension zone. The relicts have many northern species and have sustained severe alteration due to water level manipulation. This rare community type should be considered for alternative management.
- **White Pine/Red Maple Swamp:** This geographically limited swamp community is restricted to the margins of the bed of extinct glacial Lake Wisconsin. It often occurs along headwater streams and seepage areas on gentle slopes. White pine and red maple are the dominants. This very rare natural community should be considered for alternative management.

Field Survey Consultants and Other Resources

The following resources can assist in a field survey to identify state natural areas and rare natural communities:

- DNR Natural Areas staff, heritage ecologists, heritage zoologists, heritage botanists, non-game specialists, forest ecologists, or wildlife managers (see the Resource Directory).
- Local wildlife biologists, foresters, park managers or naturalists.
- Endangered Resources Web Site, dnr.state.wi.us/org/land/er/nhi/NHI_ims/onlineb.htm

Wetland Inclusions and Seasonal Ponds

PURPOSE

The purpose of wetland inclusions and seasonal ponds is to provide site-level wildlife habitat features for terrestrial species associated with wetland inclusions and seasonal ponds within forests.

RATIONALE, BACKGROUND AND BENEFITS

Wisconsin has an abundant variety of wetland inclusions and seasonal ponds. The mixture of land and water features across the landscape provides an important dimension to the habitats of many wildlife species.

Wetland inclusions and seasonal ponds are different from puddles. Wetland inclusions and seasonal ponds retain water for longer periods, and support populations of invertebrates that consume forest litter that falls into the depressions. These invertebrates provide food for birds, mammals, amphibians, and other species. Red-shouldered Hawks, a threatened species in Wisconsin, often choose forested areas that contain a number of wetland inclusions to ensure an adequate supply of prey for rearing young. Seasonal ponds are also important spring food sources for breeding waterfowl and migrating birds.

Seasonal ponds are best identified in spring when they are full of melt-water from the spring runoff. Frogs calling in spring, vegetation type or topography might provide additional clues to their location.

One important component of many forest ecosystems are amphibians, and many depend on seasonal wetlands for breeding habitat. These temporary or seasonal wetlands are important to amphibians because they do not contain fish populations, which prey on salamander eggs. Blue-spotted and spotted salamanders will enter these ephemeral wetlands as soon as they lose their ice cover in spring. Pay attention to roadsides during the first warm rain of spring, and you will literally see the forest floor crawling with salamanders traveling to breeding sites. Five species of frogs are also heavy users of wetland inclusions. Anyone who has walked along a forest road at night can recall the croaking of wood frogs, the peeping of spring peepers, and the distinctive notes of chorus frogs. Frog songs can be so loud in these wetland inclusions that they block out all other sounds. Later in the spring and early summer, Cope's and Eastern Gray treefrogs use these wetland inclusions for breeding.

WETLAND INCLUSIONS AND SEASONAL PONDS

- **Wetland inclusions** are wetland basins within an upland site.
- **Seasonal Ponds:** Sometimes called vernal pools, seasonal ponds are depressions in the soil surface where water pools during wet periods of the year, typically in the spring and fall.
 - A seasonal pond will have an identifiable edge caused by annual flooding and local topography.
 - The edge is best identified during the spring or fall, but it may be identified during dry periods by the lack of forest litter in the depression. Such depressions typically are fishless, and retain water for longer periods than puddles.

Note: Replenished annually, leaf litter is consumed during inundated periods, and noticeably depleted thereafter. Deciduous litter will likely be consumed faster and more thoroughly than conifer litter.

Because of the high biomass of amphibians in forested habitats, they are extremely important both as predators of invertebrates, and as prey for other forest wildlife species.

Applying guidelines for water quality, leave trees and snags, coarse woody debris, and slash during forest management activities can retain and create key habitat features (including woody debris, litter depth and plant cover) in these areas, while preventing siltation, excessive warming, or premature drying-up of wetland inclusions and seasonal ponds.

THE NEED FOR RESEARCH AND MONITORING

Even though the ecological importance of wetland inclusions and seasonal ponds is recognized, the total number and location of all such water bodies in Wisconsin's forests is unknown. Existing inventories, such as the National Wetland Inventory, are incomplete with regard to wetland inclusions. Furthermore, seasonal ponds are sometimes difficult to recognize in the field. Uncertainty regarding the abundance and location of wetland inclusions and seasonal ponds indicates the need to document their occurrence, and further research their role in forest ecology in Wisconsin.



Figure 3-11: Wild lupine in central Wisconsin; the Karner Blue Butterfly's only known larval food plant. The Karner Blue is listed as an endangered species, even though they are relatively abundant in parts of Wisconsin.

Riparian Wildlife Habitat

PURPOSE

The purpose of riparian wildlife habitat is to provide site-level wildlife habitat features for species that utilize riparian ecosystems.

RATIONALE, BACKGROUND AND BENEFITS

Riparian areas are among the most important parts of forest ecosystems. These areas have high plant diversity, both horizontally and vertically from the water's edge, which contributes to the high diversity of animals that live in these areas. Up to 134 vertebrate species occur in riparian forests in this region, but many of these species will also use non-riparian forest habitat. The species that are of most concern in riparian areas are "obligate" species, which require both the water and surrounding forests as habitat. In Wisconsin, obligate riparian species include amphibians, reptiles, birds, and mammals. Numerous plant and invertebrate species are also strongly associated with these habitats. Different animals are associated with different stream sizes. In general, larger animals are associated with larger streams and smaller species with smaller streams. A reverse pattern is found in some salamanders.

Although some degree of mature forest cover is desirable along many riparian areas, all habitat conditions are valid, given long-term disturbance regimes. Some wildlife species, such as woodcock, require dense woody cover that can be provided by young forest or shrub cover in riparian areas. The greatest concern for riparian habitats is in those areas of the state where uplands have been converted to agriculture, resulting in little additional forest of any kind in the region. This situation occurs more in the southeastern and western portions of the state rather than in the north, which affords more flexibility in age classes, structures and cover type (see Chapter 5: Riparian Areas and Wetlands, for specific BMPs and harvesting criteria for riparian zones).

Forest streams come in many sizes, growing from spring-fed trickles to large rivers as they move downhill, and converge with one another to drain larger and larger watersheds. Along this gradient, the ecological characteristics of a riparian area change in a gradual continuum. Because of these characteristics, management guidelines for riparian areas in general should be considered on a landscape level.

It is important to keep in mind the following wildlife-related concerns for riparian habitats:

- **Leave Trees and Snags**

- Prothonotary Warblers, Tufted Titmice, Wood Ducks, and a number of other species are dependent on existing cavities in riparian forests. Woodpeckers and chickadees select dying or diseased trees in which to excavate cavities. It is important to leave existing cavity trees and potential snags for use by the many cavity nesters that utilize riparian forests.
- Some riparian species require large super-canopy trees (trees above the existing canopy) for hunting perches and nesting sites. On larger rivers, Osprey will often perch in a large, dead white pine above a river to look for prey.
- Shade is essential for maintaining microhabitat conditions for some riparian animals. Winter Wrens, Northern Waterthrushes and many salamanders like the cool, moist conditions created by a closed canopy riparian forest. Yellow Warblers, Willow Flycatchers and some herps need more open riparian conditions. Providing a range of seral stages where appropriate will benefit a number of riparian species.

- **Coarse Woody Debris and Slash**

- Many riparian animal species require downed logs for cover. Downed logs and slash in riparian areas provides additional microsites for insects and the species that prey on these insects. Salamanders, frogs and small mammals utilize these large logs as travel routes to avoid predation.

- **Mast**

- Riparian edges often contain a higher concentration and richness of unique mast species, especially shrubs, than adjacent upland areas. It is well-documented that riparian areas are critical migratory stopover locations for birds that winter in the Neotropics. These areas often have more insect life in the spring before leafout than associated uplands. In the fall, dogwoods, nannyberry, wahoo, honeysuckle, elderberry, and other mast-producing shrubs and trees provide nourishment to birds migrating south and other species preparing for winter.

- **ETS Species (see page 68)**

- Many ETS species are found in riparian areas.
- Many of the bigger blocks of forest in the southern half of Wisconsin occur in riparian zones along the larger rivers. These are important areas for forest interior species such as Red-shouldered Hawks, Cerulean Warblers, Acadian Flycatchers, Yellow-throated Warblers, Yellow-crowned Night Heron, and a host of other species found in the southern half of the state.
- High quality streams and rivers are important habitat for many rare dragonflies, fish, mussels and clams, and other invertebrates. Often the presence of these species is used to evaluate stream health. The middle St. Croix, middle and lower Chippewa, and lower Wisconsin are good examples of riparian systems that host many rare species.

- **Natural Communities and Sensitive Sites**

- Many natural communities are associated with riparian ecosystems. Some, like floodplain forests, are always associated with riparian areas. Others, such as northern edge meadow, emergent aquatic, and alder thicket are often associated with riparian areas, but can also be found in other situations. For a complete listing and description of natural community types in Wisconsin, see the BER web site.

ECO-REGION APPLICABILITY

These guidelines are applicable statewide.

LANDSCAPE IMPLICATIONS

In areas dominated by agricultural landuse practices (in southern and east-central regions), where riparian forests represent the majority of the forests in the area, consider using uneven-aged management. Most rare species associated with these forests require high-canopy closure and large blocks of forest.



Figure 3-12: This stand of red pine has been thinned three times, and the shrub layer resulting from increased sunlight reaching the forest floor now provides good wildlife habitat.

**ETS SPECIES ASSOCIATED WITH
RIPARIAN ECOSYSTEMS**

- | | |
|---|---------------------------------|
| • Red-shouldered Hawk ¹ | • Cerulean Warbler ¹ |
| • Yellow-crowned Night Heron ¹ | • Osprey ¹ |
| • Acadian Flycatcher ¹ | • Wood Turtle |
| • Western Ribbon Snake | • Great Egret ¹ |
| • Yellow-throated Warbler ² | • Snowy Egret ² |
| • Blanchard’s Cricket Frog | • Bullfrog |
| • Prothonotary Warbler ³ | • Bald Eagle |
| • Midland Smooth Softshell Turtle | • Massasauga Rattlesnake |
| • Louisiana Waterthrush ³ | • Many rare fish species |
| • Many rare mussels and clams | |
| • St. Croix snaketail, splendid clubtail and a host of other rare dragonflies | |
| • Numerous other plants, snails and invertebrates | |

1 Threatened Species
2 Endangered Species

3 Special Concern Species



Figure 3-13: Large blocks of older forest are important to forest interior species such as this Cerulean Warbler.

RESOURCES FOR ADDITIONAL INFORMATION

AMPHIBIANS OF WISCONSIN

Amphibians of Wisconsin (2001), Bureau of Endangered Resources (BER) Publ. No. ER-105 2001, Department of Natural Resources, Madison, Wisconsin. BER publication that gives an overview of amphibian biology and conservation in Wisconsin. Provides a detailed life history and management information for each species in Wisconsin.

BUREAU OF ENDANGERED RESOURCES WEB SITE

This web site provides a wealth of information on rare species and natural communities, the State Natural Areas Program, Invasive Species, program information, and news and events regarding the Bureau, www.dnr.state.wi.us/org/land/er/

THE ENDANGERED AND THREATENED INVERTEBRATES OF WISCONSIN

The Endangered and Threatened Invertebrates of Wisconsin (1999), Bureau of Endangered Resources (BER) Publ. No. ER-085-99, Wisconsin Department of Natural Resources, Madison, Wisconsin. BER publication details life histories and general conservation issues of each listed invertebrate species in Wisconsin. Also includes a county by county listing of occurrences of these species at the end of the document.

THE ENDANGERED AND THREATENED PLANT SPECIES OF WISCONSIN

The Endangered and Threatened Plant Species of Wisconsin (1993), Bureau of Endangered Resources (BER) Publ. No. ER-067, Wisconsin Department of Natural Resources, Madison, Wisconsin. BER publication gives basic occurrence and habitat information for the listed plant species in Wisconsin. Species descriptions are separated by general habitat type. Unfortunately, this document has not been updated since 1993, so not all information is current.

THE ENDANGERED AND THREATENED VERTEBRATES SPECIES OF WISCONSIN

The Endangered and Threatened Vertebrates Species of Wisconsin (1997), Bureau of Endangered Resources Publ. No. ER-091, Department of Natural Resources, Madison, Wisconsin. BER publication that gives life history, distribution and management information for all threatened and endangered vertebrates in Wisconsin. A county by county listing of species occurrences is included, but is not up-to-date.

NATURAL HERITAGE INVENTORY ON-LINE DATABASE

This application provides users an opportunity to search the Wisconsin Natural Heritage Inventory (NHI) Program's database for the status and distribution of endangered resources, or to learn what species or natural communities are known to exist within a particular area of interest. The On-line Database is intended for information and general planning purposes rather than regulatory decision-making, www.dnr.state.wi.us/org/land/er/nhi/NHI_ims/onlineedb.htm

NATURAL HISTORY OF AMPHIBIANS AND REPTILES OF WISCONSIN

Vogt, Richard C. (1981). *Natural history of amphibians and reptiles of Wisconsin*. Milwaukee Public Museum and Friends of the Museum, Inc.. This publication is a good source of general information on the natural history of herps in Wisconsin.

RUFFED GROUSE SOCIETY

For information on the management of forest habitats for ruffed grouse and other wildlife species, contact:

The Ruffed Grouse Society
451 McCormick Road
Coraopolis, PA, 15108
Phone 412-564-6747
www.ruffedgrousesociety.org

SNAKES OF WISCONSIN

Snakes of Wisconsin (2000), Bureau of Endangered Resources (BER) Publ. No. ER-100-00, Department of Natural Resources, Madison, Wisconsin. BER publication that gives an overview of snake biology and conservation in Wisconsin. Provides a detailed life history and management information for each species in Wisconsin.

THREATENED AND ENDANGERED SPECIES OF FORESTS IN WISCONSIN: A GUIDE TO ASSIST WITH FORESTRY ACTIVITIES

Threatened and Endangered Species of Forests in Wisconsin: A Guide to Assist with Forestry Activities (2000). A joint publication of International Paper Company, U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources is available from any of the sponsors. Gives a description, life history information and forestry considerations for endangered and threatened species that utilize forested habitats.

WILD TURKEY: ECOLOGY AND MANAGEMENT IN WISCONSIN

Wild Turkey: Ecology and Management in Wisconsin (2001). Bureau of Integrated Science Services, Department of Natural Resources, Madison, Wisconsin. This publication gives a complete account of Wild Turkey re-introduction, management, and ecology in Wisconsin. Landowners interested in managing their land for Wild Turkeys should consider this source as a definitive guide to Turkey biology in Wisconsin.

WILDLIFE AND YOUR LAND: A SERIES ABOUT MANAGING YOUR LAND FOR WILDLIFE

Wildlife and Your Land: A Series About Managing Your Land for Wildlife. Bureau of Wildlife Management, Department of Natural Resources, Madison, Wisconsin. This source served as the foundation for many of the wildlife issues covered in this chapter of the *Forest Management Guidelines*. This collaborative effort focuses on different management issues land managers and owners should consider when managing their property. This series is available in hardcopy form or on the web at www.dnr.state.wi.us/org/land/wildlife/publ/wildland.htm

WISCONSIN BREEDING BIRD ATLAS WEB SITE

2002. University of Wisconsin-Green Bay, www.uwgb.edu/birds/wbba/. This web site displays the results of the Wisconsin Breeding Bird Atlas performed from 1995 to 2000 on private and public lands across the state. It is a good source of information for the range and distribution of bird species within the state. The web site will generate a species list by quad or county, and also contains pictures of the species that could be used in identification.

WISCONSIN STATE HERBARIUM: UNIVERSITY OF WISCONSIN-MADISON WEB SITE

This web site (www.botany.wisc.edu/herbarium/) contains on-line herbarium records for all plants found within Wisconsin. You can search the herbarium by species, genus or common name. Each species description contains information on location, habitat, photos, and a floristic rating. Locations are only given to the county level.

WISCONSIN'S BIODIVERSITY AS A MANAGEMENT ISSUE

Wisconsin's Biodiversity as a Management Issue (1995). Department of Natural Resources, Madison, Wisconsin. This report was written for Department of Natural Resources managers to provide them with a context for their work. This report gives an overview on the issues and implications of Wisconsin's rich biotic heritage. It also gives an overview of the ecological, social and economic issues tied to each major community type in Wisconsin. This is a good general source for information on the landscape surrounding a given property.

These resources are specific to the information in this chapter only. Refer to the Resource Directory for additional resources related to this chapter.